TIME AND WORK-I

Formulae:

(i) If P_1 persons working H_1 a day can complete W_1 units of work in D_1 days, and P_2 persons working for H_2 a day can complete W_2 units of work in D_2 days then

$$\frac{P_1H_1D_1}{W_1} = \frac{P_2H_2D_2}{W_2}$$

(ii) If the amount of work is not mentioned in either of the two cases then it should be treated as same in both the cases then $P_1D_1H_1 = P_2D_2H_2$

(iii) Even if the working hours not mentioned in both the cases then H_1 & H_2 can be dropped.

$\Rightarrow P_1D_1 = P_2D_2$

(iv) A can do a work in x days. If B is k times as efficient as A then B can do the work in $\frac{x}{k}$ days. Both A and B together can do the work in $\left(\frac{x}{k+1}\right)$ days.

PROBLEMS

1. Four examiners can examine a certain number of answer papers in 10 days by working for 5 hours a day. For how many hours in a day would 2 examiners have to work in order to examine twice the number of answer papers in 20 days?

1) 8 hours 2) $7\frac{1}{2}$ hours 3) 10 hours 4) $8\frac{1}{2}$ hours 5) None of these

ANSWER: 3

Let the number of answer papers examined be x in the first case, then the number of answer papers examined in the second case will be $2x$

$P_1 = 4 \quad H_1 = 5 \quad D_1 = 10 \quad W_1 = x$

$P_2 = 2 \quad H_2 = ? \quad D_2 = 20 \quad W_2 = 2x$

But $\frac{P_1H_1D_1}{W_1} = \frac{P_2H_2D_2}{W_2}$

$\therefore \frac{4\times5\times10}{x} = \frac{2\times H_2\times20}{2x}$

$\therefore H_2 = \frac{\overset{5}{\cancel{200}}\times 2\cancel{x}}{\cancel{x}\times\cancel{40}} = 10$

2. 7 men can complete a piece of work in 12 days. How many additional men will be required to complete double the work in 8 days?

1) 28 2) 21 3) 14 4) 7 5) None of these

ANSWER: 2

$P_1 = 7 \quad D_1 = 12 \quad W_1 = 1$

$P_2 = ? \quad D_2 = 8 \quad W_2 = 2$

$\frac{P_1D_1}{W_1} = \frac{P_2D_2}{W_2}$

$$\frac{7\times12}{1}=\frac{P_2\times8}{2}$$

$$\therefore P_2=\frac{7\times12}{4}=21$$

3. 15 men take 21 days of 8 hours each to do a piece of work. How many days of 6 hours each would 21 women take, if 3 women do as much work as 2 men?

1) 18 2) 20 3) 25 4) 30 5) None of these

ANSWER: 4

3 women = 2 men

$\Rightarrow$ 21 women = 14 men

$P_1=15 \quad H_1=8 \quad D_1=21$

$P_2=14 \quad H_2=6 \quad D_2=?$

But $P_1H_1D_1 = P_2H_2D_2$

$15 \times 8 \times 21 = 14 \times 6 \times D_2$

$$\therefore D_2=\frac{15\times8\times21}{14\times6}=30$$

4. 25 men can do a piece of work in 24 days. How many men would be required to do the same work in 10 days?

1) 56 2) 60 3) 64 4) 66 5) 72

ANSWER: 2

$P_1=25 \quad D_1=24$

$P_2=? \quad D_2=10$

$P_1D_1 = P_2D_2$

$25 \times 24 = P_2 \times 10$

$$\therefore P_2=\frac{25\times24}{10}=60$$

5. A job can be completed by 12 men in 12 days. How many extra days will be needed to complete the job in 6 men leave after working for 6 days?

1) 3 2) 6 3) 12 4) 24 5) None of these

ANSWER: 3

Six men leave after six days. So the work which is to be done by 12 men in 6 days must be done by 6 men only.

$P_1=12 \quad D_1=6$

$P_2=6 \quad D_2=?$

$\therefore 12 \times 6 = 6 \times D_2$

$\therefore D_2 = 12$

6. A builder decided to build a house in 50 days. He employed 150 men at the beginning and another 80 men after 20 days and completed the work in stipulated time. If he had not employed the additional men, how many days behind schedule would it have been finished?

1) 10 days 2) 12 days 3) 15 days 4) 16 days 5) 18 days

ANSWER: 4

Builder employs 150 men for first 20 days and 150 + 80 = 230 men for the remaining 50 – 20 = 30 days to complete the work in stipulated time.

If additional 80 men are not employed then the work which is done by 230 men in 30 days should be done by 150 men only i.e.

$P_1 = 230 \qquad D_1 = 30$

$P_2 = 150 \qquad D_2 = ?$

$\Rightarrow 230 \times 30 = 150 \times D_2$

$\therefore D_2 = \frac{230 \times 30}{150} = 46$

The schedule will be extended by 46 – 30 = 16 days

7. Two men alone or three women alone can complete a piece of work in 4 days. In how many days can 1 woman and one man together complete the same piece of work?

1) 6 days 2) $\frac{24}{5}$ days 3) $\frac{12}{1.75}$ days 4) Cannot be determined 5) None of these

ANSWER: 2

Two men or three women can do the work in same time

$\Rightarrow 2M = 3W$

$\therefore 1M + 1W = \frac{3W}{2} + 1W = \frac{5W}{2}$

$P_1 = 3 \qquad D_1 = 4$

$P_2 = \frac{5}{2} \qquad D_2 = ?$

$\therefore 3 \times 4 = \frac{5}{2} \times D_2$

$\therefore D_2 = \frac{12 \times 2}{5} = \frac{24}{5}$

8. If one man or three women or five boys can do a piece of work in 46 days then how many days will one man, one woman and one boy together take to complete the same piece of work?

1) 30 days 2) 32 days 3) 35 days 4) 40 days 5) None of these

ANSWER: 1

One man or three women or five boys can do a piece of work in same time

$\therefore 1M = 3W = 5B$

$\therefore 1M = 5B$ and $3W = 5B$

$\therefore 1M + 1W + 1B = 5B + \frac{5B}{3} + 1B = \frac{23B}{3}$

Now consider the boys strength to solve the problem

$P_1 = 5 \qquad D_1 = 46$

$P_2 = \frac{23}{3} \qquad D_2 = ?$

$\Rightarrow 5 \times 46 = \frac{23}{3} \times D_2$

$\therefore D_2 = \frac{5 \times 46 \times 3}{23} = 30$

9. 8 men can complete a piece of work in 20 days. 8 women can complete the same piece of work in 32 days. In how many days will 5 men and 8 women together complete the same work?

1) 16 days 2) 12 days 3) 14 days 4) 10 days 5) None of these

ANSWER: 1

8 men can do the work in 20 days and 8 women in 32 days

$\therefore 8M \times 20 = 8W \times 32$

$\therefore 20M = 32W \Rightarrow 5M = 8W$

$\therefore 5M + 8W = 8W + 8W = 16W$

Now consider the women strength to solve the problem

$P_1 = 8 \quad D_1 = 32$

$P_2 = 16 \quad D_2 = ?$

$\therefore 8 \times 32 = 16 \times D_2$

$\therefore D_2 = \frac{8 \times 32}{16} = 16$

10. 2 men can complete a piece of work in 6 days. 2 women can complete the same piece of work in 9 days, whereas 3 children can complete the same piece of work in 8 days. 3 women and 4 children worked together for 1 day. If only men were to finish the remaining work in 1 day, how many total men would be required?

1) 4 2) 8 3) 6 4) Cannot be determined 5) None of these

ANSWER: 2

$2M \times 6 = 2W \times 9 = 3C \times 8$

$\Rightarrow 12M = 18W = 24C$

$12M = 18W \quad 12M = 24C$

$\Rightarrow 2M = 3W \quad 1M = 2C$

But $3W + 4C = 2M + 2M = 4M$

If x be the number of men required to finish the remaining work in 1 day

$2 \times 6 = 4 \times 1 + x \times 1$

$\Rightarrow x = 12 - 4 = 8$

11. X can do a piece of work in 24 days. If Y works twice as fast as X, how long would they take to finish the work working together?

1) 8 days 2) 12 days 3) 16 days 4) 48 days 5) 36 days

ANSWER: 1

X's one day work = $\frac{1}{24}$

$\therefore$ Y is twice as fast as X

Y's one day work = $2 \times \frac{1}{24} = \frac{1}{12}$

(X + Y)'s one day work = $\frac{1}{24} + \frac{1}{12} = \frac{1+2}{24} = \frac{1}{8}$

X and Y together can do the work in 8 days.

SHORTCUT METHOD:

By applying the formula (iv) discussed above

$x = 24$ k = 2

So X and Y together can do the work in $\frac{x}{k+1} = \frac{24}{2+1} = 8$ days

12. Yesterday Vani completed 300 units of work at the rate of 15 units per minute. Today she completed the same units of work but her speed was 40% faster than yesterday. What is the **approximate** difference in the time she took to complete the work yesterday and the time she took today?

1) 16 minutes 2) 26 minutes 3) 46 minutes 4) 36 minutes 5) 6 minutes

ANSWER: 5

Yesterday time taken by Vani to finish the work = $\frac{300}{15} = 20$

Today she is 40% faster i.e. 140% as efficient as the other day

Today time taken by her to finish the work = $\frac{20}{140\%} = \frac{20 \times 100}{140} \cong 14\text{min}$

The required difference = 20 – 14 = 6 min

SHORTCUT METHOD:

Applying the same formula

$x = \frac{300}{15} = 20$ k = (100 + 40)% = $\frac{140}{100} = 1.4$

So today Vani can finish the work in $\frac{20}{1.4} \cong 14$ days

Required difference = 20 – 14 = 6 min